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Experimental and Numerical investigation of a droplet-laden turbulent flow: preferential concentration due to turbulence and its influence on droplet collisions and growth ALBERTO ALISEDA, COLIN BATESON, University of Washington, ORLANDO AYALA, HOSSEIN PARISHANI, LIAN-PING WANG, University of Delaware, BOGDAN ROSA, IMWM, Poland — We have conducted a multi-laboratory investigation of the dynamics of small inertial droplets ($St \approx 0.1 - 1$) immersed in homogeneous isotropic turbulence. We compare experimental results from a wind tunnel experiment with Direct Numerical Simulations of slowly decaying homogeneous isotropic turbulence laden with spherical droplets. The Reynolds number (Re_λ) in both cases is of the order of 200 and the particle distribution is polydisperse with droplets in the $10 - 30$ μm range. We compare the one-dimensional Radial Distribution Function from the experiments to the 1D, 2D and 3D RDFs from the simulations to validate the numerical treatment of the droplet dynamics in close proximity, and to develop methods to extrapolate the experimental measurements to 3D. We also compare the relative velocity of a pair of droplets, obtained along a line or in a plane from PDPA and PIV measurements, to the equivalent statistics obtained from the 3D velocity fields in the DNS. These are key components of the droplet collision kernel necessary to calculate turbulence-induced collision-coalescence and droplet growth.

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